The Station has no resident staff; permanent facilities are at present limited to ordinary domestic requirements and a laboratory fitted with light, power and water, but to which equipment is brought from the mainland according to the needs of particular work. The proximity of the Station to Perth and the University and the accessibility of Rottnest by boat and aeroplane, has thus made it possible to conduct much valuable research at a relatively insignificant cost. The policy of the management committee is to facilitate in every way the academic study of fauna and flora and the study of economically valuable organisms within the purview of State Fisheries and C.S.I.R.O. The concern of the Committee for the preservation of this unique habitat led to an approach to the Australian Academy of Science for funds to extend the fenced enclosures. A grant was made and two fences have been erected. In addition to workers from the sponsoring bodies, a number of visiting biologists have used the Station for short periods and it is hoped that more may be welcomed in the future.

E. P. HODGKIN.

12.—Geology of Rottnest Island

Introduction

Rottnest Island lies on the continental shelf along the western flank of the Perth Basin. It forms the northern termination of two parallel chains of low islands and shallow reefs that strike in a north-north-westerly direction from the vicinity of the mainland south of Perth. Both chains are composed mainly of Quaternary aeolianite and represent major series of calcareous sand dunes which formed close to the shore line when the sea-level was considerably lower than at present. The eastern chain consists of the Murray Reefs, Seal Island, Bird Island, Point Peron, Garden Island, Carnac Island and the Stragglers Reefs; the second chain lies approximately two miles to the west of the first and includes Coventry Reef, Hawley Shoal and Casuarina Shoal. Gravity surveys (Vening Meinesz 1948; Thyer and Everingham 1956) show Bouguer Anomalies of between -65 and -70 milligals in the vicinity of Rottnest Island and suggest that a thickness of about 20,000 feet of sedimentary rocks separates the surface exposures from the underlying crystalline basement complex.

Recent contributions to our knowledge of the geology of Rottnest Island have been made by Teichert (1950) and Fairbridge (1954). The present authors wish to acknowledge the valuable assistance of Mr. B. E. Balme, Dr. E. P. Hodgkin, Mr. P. E. Playford and Miss M. E. Redman in the compilation of this review. Two of us (C.W.H., E.W.S.K.) are currently engaged in a study of the geology of Rottnest Island.

Succession

All rock exposures on Rottnest Island are thought to be of Quaternary age, but Tertiary and Cretaceous strata were penetrated in the Rottnest Island Bore. This bore was drilled near the Rottnest Cemetery at a surface elevation of approximately 10 feet above mean-sea-level. It reached a total depth of 2,582 feet. A Lower Cretaceous sequence of dark grey, sandy, glauconitic claystone and shale and dense sandstone was penetrated between 2,185 feet and 2,582 feet; this interval is correlated with the South Perth Formation, known from bores in the Perth Metropolitan Area. The overlying Kings Park Shale is a marine formation which extends from 933 feet to 2,185 feet. It consists of impure sandstone, grey sandy shale, and thin beds of impure limestone. Numerous fragmentary invertebrates were recovered from the available cores. Spore and pollen studies confirm the correlation with the Middle to Upper Eocene Kings Park Shale of the Perth bores. Coarse-grained, red, brown and yellow sandstone occupies the interval between the base of the "Coastal Limestone," at 233 feet, and the top of the Kings Park Shale, at 933 feet. Samples of this part of the section are not available for study, but the unit may represent part of an ancient delta of the Swan River. A thin unnamed formation of late Tertiary or Pleistocene age occurs below the "Coastal Limestone" in the Public Works Department Swan River bores directly to the west of the Fremantle Traffic Bridge. It is perhaps of similar age and origin to the sandstone beneath the "Coastal Limestone" in the Rottnest Island Bore. Sandy limestone extends from the top of the unnamed sandstone formation, at 233 feet, to the surface of the bore.

The Rottnest Island Bore, which is the second deepest hole drilled in the Perth Basin, penetrated the thickest known section of the Kings Park Shale. Comparison of the depths of formations in the bores of the Perth area suggests that the Mesozoic and Tertiary sections in this area are faulted.

Exposures

All lithified strata exposed on Rottnest Island are referred to the "Coastal Limestone." They consist predominantly of coarse-grained, cross-bedded aeolianite and include minor developments of marine limestone. Fossil soils of limited areal extent are fairly common in the cliff sections west of Narrow Neck.

The aeolianite of the "Coastal Limestone" is similar in composition to the sands on the present day beaches of the island. It is composed mainly of comminuted shells, calcareous algae, Foraminifera and other calcareous microfossils, but includes rounded quartz grains and minor amounts of heavy minerals. Quartz grains are

usually only minor constituents of the aeolianite, but in some bands within the fossil dunes they reach a high concentration.

An emerged coral reef in Salmon Bay, lithified shell deposits at Geordie Bay, and the shell beds around the margins of the salt lakes represent marine incursions into the "Coastal Limestone" during periods of higher sea-level. The fossil soils are characterised by their massive structure and the presence of the terrestrial gastropod *Bothriembryon*. They formed fairly rapidly in flat interdunal areas and do not exhibit signs of soil maturity.

Soils forming at the present time are shallow and immature. They show the initial stage in soil formation, namely the accumulation of organic matter near the surface.

Physiography

Rottnest Island is characterized by rolling sand dune topography, and reaches a maximum elevation of only 154 feet. Permanent drainage channels are absent, but a number of swamps form in favourable interdune locations during winter (see p. 85 herein). The system of salt lakes represents shallow arms of the sea which were isolated in recent times, by bar and dune formation near the present coast.

A striking physiographic feature of the Island is the ubiquitous occurrence of narrow marine benches situated a few feet above mean-sea-level along the present coastline and around the margins of the salt lakes. Previous authors (Teichert 1950; Fairbridge 1954) have interpreted these features as remnants of low-water-level marine benches formed during recent eustatic still-stands or slow retreat of sea-level. Benches at 10-11 feet above the present mean-sea-level have been related to the "Flandrian" sea-level of Europe, those at 5-6 feet to the "Calaisian" and those at 2-3 feet to the "Dunkirkian." Emerged coral reefs at Salmon Bay and Stark Bay and shell beds around the lakes yield unmistakable evidence of higher sea-levels. However, studies in progress suggest at least some of the low-water-level benches formed during these periods of higher sea-level have been either drastically remodelled or obliterated by rapid erosion. Some of the benches around the present coastline appear to owe their form to surface induration of the aeolianite near the upper limit of the splash zone, and it therefore seems that they are unrelated to eustatic phenomena.

A fall in present sea-level of approximately five fathoms would link Rottnest Island to the mainland as a peninsula extending through Garden Island to Point Peron. Fossil pollen and radiocarbon studies (Churchill 1959) indicate that, approximately 5,000 years B.C., sea-level stood five fathoms lower than at present. The separation of Rottnest as an island is thus a young geological event.

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13.—The Vegetation of Rottnest Island

Our earliest record of the vegetation of what is now Rottnest Island comes from fossil pollen and megascopic remains in swamp sediments and dunes of late Pleistocene age. Apart from species still found on the Island, the past occurrence of *Eucalyptus gomphocephala*, *E. marginata*, *E. ealophylla*, *Agonis*, *Casuarina*, *Banksia*, *Macrozamia* and *Xanthorrhoea* indicates that a tuart woodland similar to that of the present mainland once existed here. Since then, rising sea-level and erosion have reduced the area to an island, 7 miles long and 3 miles wide. Consequent increase in wind exposure and deterioration in rainfall have played their part in rendering former habitats unsuitable for tuart woodland. Thus the present vegetation consists solely of elements of a *coastal complex*.

Supralittoral Vegetation

In comparison with the mainland, the strand plants *Cakile maritima* and *Arctotheca nivea*, and the fore-dune species *Spinifex hirsutus* and *Tetragonia zeyheri*, are rare on the island. The dominant plant of Rottnest fore-dunes is *Spinifex longifolius;* associated with it are *Atriplex isatidea* and the introduced *Anthericum divaricatum*.

An entirely different suite (mostly of succulents) occupies rocky shores: *Carpobrotus aequilaterus*, *Threlkeldia diffusa*, *Tetragonia implexicoma*, *Sporobolus virginicus*, *Eremophila glabra*, *Nitraria schoberi*, *Enchylaena tomentosa*, *Arthrocnemum halocnemoides*, *Salicornia australis* and *Atriplex paludosa*. Many of these species are now abundant only on offshore stacks and islets. Except at Cape Vlaming, excessive browsing by quokkas in summer has exterminated or impoverished most of the succulent-dominated communities on the main island coast.

Coastal Dune Vegetation

This is a fairly open formation of low, generally microphyllous, shrubs, 1 to 5 feet high. Composition and height depend on wind exposure and depth of sand over the consolidated dune. The succession from sandy shores is usually